Oct. 18_3. Moved to New Mexico and Manitoba; light rain in North Dakota.
19_2. Stretches from New Mexico to Minnesota; light rain in rear extreme north.
27_3. Trough; no rain.
30_1. Nearly stationary; no rain; great high in middle Minnesota.

1887.

Oct. 3_3. Trough; no rain.
4_3. Stretches from New Mexico to North Dakota; rain in North Dakota only.
5_2. New Mexico to Minnesota; no rain.
5_3. Trough; no rain.
7_1. Stretches from New Mexico to Manitoba; light rain in North Dakota only.
7_3. Stretches from New Mexico to Lake Superior; light rain in Minnesota and Dakota.
8_1. Northern Texas to Lake Superior; rain in Texas and middle and upper Mississippi valleys.
14_1. Trough, no rain.
15_2. West Texas to Manitoba; light rain in Dakota only.
16_2. Texas to Lake Superior; light rain in middle Gulf and upper lakes.

1888.

Oct. 2_1. Trough.
3_1. Stretches from New Mexico to Minnesota; light rain in Colorado.
17_1. Trough; rain in north Pacific.
17_2. Arizona to Montana; light rain in Montana.
18_1. Concentrated in Iowa; light rain in Missouri, middle and upper Mississippi valleys.
30_2. Trough.
31_2. Light rain in Montana only; trough not well formed.

1884.

Nov. 21_1. Trough.
21_2. Rain at Calgary and in Arizona, broken up by high to the north of Montana.

1885.

Nov. 4_2. Marked low, north Pacific, with rain there.
4_3. About stationary; rain in Utah, Wyoming, and western Colorado.
5_3. Stationary; rain, 0.42 at Salt Lake City; trough gradually filling up.
20_1. Trough, with rain in Arizona.
20_3. Filling up; rain at Salt Lake City, 0.12.
21_1. Concentrated, Colorado; no rain.
22_1. In middle Mississippi Valley; rain in rear.
24_3. Disturbed region, with rain on Pacific coast.
25_3. Not well defined; rain, 0.48 at Salt Lake City, and 0.19 at Prescott.
26_3. Stretches from Texas to Manitoba; rain in Texas, Colorado, and Nebraska.
27_1. Concentrated in Texas, with rain there and in lower Mississippi Valley.

1886.

Nov. 7_1. Trough.
7_2. Rain at Santa Fe and Elliott.
9_1. Concentrated in Minnesota; rain in Mississippi Valley.
20_2. Mostly in Idaho, with rain in rear.
21_2. Concentrated at Salt Lake City, with rain in Utah.
22_2. Concentrated in South Dakota; rain in Missouri, Ohio, middle and upper Mississippi valleys.

1888.

Nov. 17_1. Disturbance on Pacific coast, with rain there.
19_1. Still stationary on Pacific coast, with rain north; no motion east.
22_2. Disturbance on Pacific; rain on middle and north Pacific.
25_2. Still stationary, Pacific, with rain in Arizona and north Pacific.
26_2. Stretches from Arizona to Manitoba; rain in Texas; none north; disturbance disappearing.

SPECIAL CONTRIBUTIONS.

STATISTICS OF STATE WEATHER SERVICES.

[By OLIVER L. FASSIG, Librarian U. S. Weather Bureau.]

To those interested in the study of local climates in the United States it may be of interest to have, in convenient form for reference, some facts relating to the organization and published reports of the various State weather services. The entire domain of the United States, with the exception of Alaska, is now covered by organized State or Territorial services under the joint control of the National Weather Service and the respective States and Territories. The complete system at present includes about 3,000 observing stations, at which the ordinary elements of the weather are regularly recorded, and published from month to month.

Some of the monthly and annual reports have been printed regularly in pamphlet or book form from the establishment of the service. Others have variously appeared as separate publications or in connection with the crop reports or agricultural reports of the several States. Many have been published only in small numbers by means of some duplicating process, such as that of the milliograph.

The style of publication has varied greatly, not only in the different States, but also in the same State from time to time. It is to be regretted that some uniform size and style of printing has not yet been adopted for the publication of these valuable reports.

From replies to questions sent to the directors of the State Weather Services, and by means of the nearly complete file of the publications of these services in the library of the Weather Bureau, an attempt is here made to present in the order indicated: (1) The name of the State; (2) the location of the central office; (3) the name of the director on July 1, 1895; (4) the date of organization and by whom organized, and the local or State aid received; (5) the date of the first weather report and the first weather crop bulletin published; (6) the character of the first report, whether printed or milliographed; (7) the number of active stations on July 1, 1895; (8) the title of the report issued for June, 1895; (9) remarks.

It has been found difficult in all cases to get entirely accurate information relating to the early history of some of the State organizations, and some minor errors doubtless occur in these statistics. The writer will be pleased to have any such errors brought to his attention.

ALABAMA.—Central office, Montgomery. Director, F. P. Chaffee.† Organized February, 1884, by Prof. P. H. Mell. First report, March, 1884, printed at Auburn. Published by the State department of agriculture. First weather-crop bulletin, May 21, 1887. Number of stations, January 1, 1895, 60. Title of publication for June, 1895: The Alabama Weather Report. Contained in The Southern Agriculturist, volume 24, No. 14, July, 1895. Fol. Montgomery. Published continuously with the exception of July and August, 1887. Report milliographed from July, 1893 to January, 1894, inclusive.

ALASKA.—No organization as yet.

ARIZONA.—Central office, Tucson. Director, W. F. Burrows.* Organized October, 1891, by J. C. Hayden. First report, October, 1891, milliographed by U. S. Weather Bureau. First weather-crop bulletin,

April 8, 1892. Number of stations July 1, 1895, 42. Title of publication for June, 1895: Bulletin No. 45. 14 by 8 inches. Tucson. 2 pp. Milliographed. Reports for January to August, 1893, printed in Arizona Weather Magazine, published monthly, devoted to climate and resources of Arizona Territory. Vol. I, No. 1–3. Tucson. June–August, 1893. Title changed to Bulletin.

ARKANSAS.—Central office, Little Rock. Director, F. H. Clarke.† Organized January, 1887, by W. U. Simons, observer Weather Bureau. First report, January, 1887. Published by the State commissioner of agriculture. First weather-crop bulletin, March, 1887. Number of stations July 1, 1895, 51. Title of publication for June, 1895: Monthly Weather Report. Obl. 4to. Little Rock. 3 pp. Reports were sometimes milliographed and published separately and sometimes printed and published in connection with other publications.

CALIFORNIA.—Central office, Sacramento. Director, James A. Barwick.* Organized September 1, 1891, by James A. Barwick. First report, September, 1891. Published by State agricultural society. First weather-crop bulletin, May 3, 1890. Number of stations July 1, 1895, 335. Title of publication for June, 1895: Monthly Bulletin. In cooperation with State agricultural society. Vol. VII, No. 6. 8vo. Sacramento. 13 pp., 1 pl. Annual meteorological returns have been published by Mr. Barwick in the annual report of the Agricultural Society since 1882.

COLORADO.—Central office, Denver. Director, F. H. Brandenburg.* Organized January 9, 1885, as the Colorado Meteorological Association. $2,000 were appropriated by legislature March 29, 1889. First report, April, 1886 (milliographed). Published by the Colorado Meteorological Association and State board of agriculture. First weather-crop bulletin, March 28, 1891. Number of stations July 1, 1895, 95. Title of publication for June, 1895: Monthly Review. Milliographed. Reports were issued from April, 1886, to July, 1889, by the Colorado Meteorological Association and from July, 1889, to December, 1889, by the State board of agriculture. From December, 1889, to April, 1890, duplicated by typewriter and cyclostyle. Issue stopped April, 1890, but resumed March, 1891.

CONNECTICUT.—(*See* **NEW ENGLAND.**)

DAKOTA.—Central office, Huron. Director, S. W. Glenn.* Organized in 1889 by S. W. Glenn. First report, June, 1889 (milliographed). Published by the U. S. Weather Bureau. The Dakota weather service was established August, 1885, and monthly weather reports published in the Monthly Bulletin of the Commissioner of Immigration for the Territory of Dakota at Huron in 1885, 1886, and 1887. 4to. Huron. 1885–'87. In July, 1891, the Dakota service was divided into North and South Dakota weather services. For continuation, see North and South Dakota.

DELAWARE.—(*See* **MARYLAND.**)

DISTRICT OF COLUMBIA.—(*See* **MARYLAND.**)

FLORIDA.—Central office, Jacksonville. Director, A. J. Mitchell.* Organized July, 1891, by E. R. Demain. First report, September, 1891 (milliographed), published by the U. S. Weather Bureau. First weather-crop bulletin, March 4, 1892. Number of stations July 1, 1895, 37. Title of publication for June 1, 1895: Monthly Bulletin, Florida Weather Service. Published in Florida Monthly Bulletin, Bureau of Immigration. Vol. IV, No. 28. Tallahassee.

GEORGIA.—Central office, Atlanta. Director, G. E. Hunt.† Organized October, 1891, by Park Morrill. The Atlanta Constitution aided in publishing crop bulletins. First report, October, 1891 (milliographed), published by U. S. Weather Bureau. First weather-crop bulletin, March 26, 1892. Number of stations July 1, 1895, 62. Title of publication for June, 1895: Georgia Weather Review. Published in The Southern Cultivator and Industrial Journal, for August, 1895. 4to. Atlanta. 1895. Prior to April, 1878, weather reports were of a very desultory character, but after that date a regular system was begun, reports being taken from old circulars or furnished by observers. This was continued with considerable fullness until 1884, when the results were incorporated in The Commonwealth of Georgia.

IDAHO.—Central office, Idaho Falls. Director, D. P. McCallum.* Organized July, 1892, by James H. Smith. First report, April, 1893 (milliographed), published by the U. S. Weather Bureau. First weather-crop bulletin, May 2, 1893. Number of stations July 1, 1895, 31. Title of publication for June, 1895: Monthly Report. 14 by 8 inches. Idaho Falls. 3 pp., 1 ch.

ILLINOIS.—Central office, Chicago. Director, Prof. W. L. Moore; C. E. Linney,* assistant director. Organized in 1886 by Col. Charles F. Mills, Secretary State board of agriculture. First report, January, 1885, published by the State board of agriculture. First weather-crop bulletin, May 21, 1887. Number of stations July 1, 1895, 105. Title of publication for June, 1895: Weather and Crops. Vol. I, No. 7. 4to. Chicago. 8 pp. Printed reports were issued from July, 1877, to September, 1886, sometimes separately and sometimes in connection with the report of the State board of agriculture. Title changed to Monthly Weather Review of Illinois State Weather Service, October, 1886, to December, 1888. No reports were published from January to November, 1889. Publication resumed December, 1889.

INDIANA.—Central office, Indianapolis. Director, Prof. H. A. Huston; C. F. R. Wappenhans,* assistant director. Organized June, 1882, by John B. Conner, State statistician. First report, September, 1884, published by Purdue University and Indiana State board of trade. First weather-crop bulletin, May, 1887. Number of stations July 1, 1895, 70. Title of publication for June, 1895: Indiana Weather Service. Purdue University, cooperating with the U. S. Department of Agriculture, Weather Bureau. 8vo. La Fayette. 11 pp. Monthly reports of mean temperature at a half dozen localities in the State were published from 1872 to 1881. The service was transferred to Purdue University, La Fayette, in March, 1883. From September, 1884 to 1886, the director issued the monthly bulletin from LaFayette; at other times from Indianapolis.

INDIANA.—Central office, Greencastle. Director, W. H. Ragan. Organized August, 1884, by W. H. Ragan, at De Pauw University. First report, August, 1884 (milliographed), published by De Pauw University. From December, 1884, to September, 1886, single printed sheets were issued. Reports were discontinued after September, 1886.

IOWA.—Central office, Iowa City. Director, Prof. Gustavus Hinrichs. Organized in the fall of 1875, by Prof. Gustavus Hinrichs. March 15, 1878, the General Assembly appropriated $1,000 annually. In 1890 this act was repealed. First report was for 1876, printed as an appendix to the report of the Iowa State Agricultural Society for 1876. Published by the State. After the organization of the service by the State, monthly press bulletins were published by Dr. Hinrichs, who was appointed director.

IOWA.—Central office, Des Moines. Director, John R. Sage; Dr. G. M. Chappel,† assistant director. Organized March, 1889, by Dr. Geo. M. Chappel. In 1890 the General Assembly established the Iowa Weather and Crop Service, and ordered the reports to be printed by the State printer. First report, May, 1889 (milliographed), by the State board of agriculture. First weather-crop bulletin, April 6, 1889. Number of stations July 1, 1895, 105. Title of publication for June, 1895: Monthly Review. Vol. VI, No. 6. 4to. Des Moines. 15 pp.

KANSAS.—Central office, Topeka. Director, T. B. Jennings.* Organized January, 1887, by T. B. Jennings and Prof. J. T. Lovewell, Washburn College. First report, February, 1887. Published by State board of agriculture. First weather-crop bulletin, April 7, 1888. Number of stations, July 1, 1895, 79. Title of publication for June 1895: Kansas Weather Review. Milliographed. 14 by 8 inches. Topeka. 5 pp. Previous to 1887 the data appeared in the reports of the State board of agriculture.

KENTUCKY.—Central office, Louisville. Director, Frank Burke.† Organized early in 1888, by Prof. E. A. von Schweinitz. First report, January, 1889. Published by the State Agricultural and Mechanical College. First weather-crop bulletin, April, 1888. Number of stations July 1, 1895, 48. Title of publication for June, 1895: Kentucky Weather Service. 8vo. Louisville. 6 pp. The central station was transferred from Lexington to Louisville, July, 1888. Reports were printed during 1889, and since January, 1895.

LOUISIANA.—Central office, New Orleans. Director, R. E. Kerkam.† Organized October 22, 1887, by R. E. Kerkam. First report, November, 1887. Published by Sugar Planters' Association, Cotton Exchange, and Sugar Exchange. First weather-crop bulletin, March 3, 1888. Number of stations July 1, 1895, 59. Title of publication for June, 1895: Louisiana Weather Journal and Agriculturist. Vol. 8, No. 8. Fol. New Orleans. 10 pp. In 1884 a service was established by local commercial bodies with R. S. Day, of the Cotton Exchange, as director, and Myer Herman, of the Signal Service, as secretary. Monthly reports were printed with some lapses from April, 1884, to May, 1885.

MAINE.—(*See* **NEW ENGLAND.**)

MARYLAND (including Delaware and the District of Columbia).—Central office, Baltimore. Director, Dr. William B. Clark; Dr. C. P. Cronk,* assistant director. Organized May 1, 1891, by Wm. B. Clark, of Johns Hopkins University, Milton Whitney, of Maryland Agricultural College, and C. P. Cronk, of U. S. Weather Bureau. From May to November, 1891, the expense was borne by Johns Hopkins University. April 7, 1892, the legislature appropriated $2,000 per annum. First report May 1, 1891. Published by Johns Hopkins University, Maryland Agricultural College, and U. S. Weather Bureau. First weather-crop bulletin, June 26, 1891. Number of stations July 1, 1895, 58. Title of publication for June, 1895: Monthly Report. Vol. V, No. 3. 4to. Baltimore. 8 pp. 1 ch.

MASSACHUSETTS.—(*See* **NEW ENGLAND.**)

MICHIGAN.—Central office, Lansing. Director, C. F. Schneider.* Organized December 1, 1886, by N. B. Conger, at Lansing. Appropriations were received from the legislature from 1887 to 1890. First report, February, 1887. Published by the State board of agriculture. First weather-crop bulletin, May 7, 1887. Number of stations July 1, 1895, 75. Title of publication for June, 1895: Weather Bulletin. Vol. 10, No. 7. 8vo. Lansing. 19 pp.

MINNESOTA.—Central office, Minneapolis. Director; E. A. Beals.* Organized in 1882, by Prof. W. W. Payne. Supported by St. Paul

Chamber of Commerce and railroad corporations; contribution of $50 per month. First report, December, 1884. Published by St. Paul Chamber of Commerce and railroad corporations. First weather-crop bulletin, March 30, 1889. Number of stations July 1, 1895, 74. Title of publication for June, 1895: Minnesota Weather and Crop Review. 4to. Minneapolis. 8 pp. The central station was at Northfield from the time of establishment to February, 1886, then removed to St. Paul. September, 1890, it was removed to Minneapolis. Reports were milliographed from 1890 to March, 1895.

MISSISSIPPI.—Central office, Vicksburg. Director, Dr. Robert J. Hyatt.† Organized in the spring of 1884 by Prof. R. B. Fulton, of the University of Mississippi. First report, July, 1884, printed in newspaper of August, 1884. First weather-crop bulletin, April, 1887, published by University of Mississippi. Number of stations July 1, 1895, 56. Title of publication for June, 1895: Monthly Report. 14 by 8 inches. Vicksburg. 4 pp. 1 map. Milliographed. Reports of temperature and rainfall were tabulated and published in the newspapers irregularly from the spring of 1884 to the fall of 1886. Since then the reports have been issued separately.

MISSOURI.—Central office, Columbia. Director, J. R. Rippey; A. E. Hackett,* assistant director. Organized in 1877 by Prof. Francis E. Nipher, of Washington University, St. Louis. Carried on by private means from 1877 to 1889. State assistance received since 1891. First report, January, 1890, published by State board of agriculture. First weather-crop bulletin March 15, 1890. Number of stations July 1, 1895, 122. Title of publication for June, 1895: Monthly Bulletin. In cooperation with the State board of agriculture. Vol. VII, No. 6. Royal 8vo. Columbia. 7 pp. The central office was removed from Washington University, St. Louis, to Columbia, in the summer of 1889, and the service placed under the control of the State board of agriculture. Milliographed monthly reports were issued from January, 1878, to March, 1883.

MONTANA.—Central office, Helena. Director, R. M. Crawford.* Organized November, 1891, by E. J. Glass. First report, November, 1891 (milliographed), published by U. S. Weather Bureau. First weather crop bulletin, April 16, 1892. Number of stations July 1, 1895, 43. Title of publication for June, 1895: Monthly Meteorological Summary. 14 by 8 inches. Helena. 2 pp. Milliographed. From March, 1892, to April, 1893, the reports were printed.

NEBRASKA.—Central office, Lincoln. Director, Prof. Goodwin D. Sweezy; G. A. Loveland,* assistant director. Organized January, 1878, by Gilbert E. Bailey and Wayland Bailey, at Lincoln. First report, spring of 1878 (milliographed), published by Doane College. Number of stations July 1, 1895, 121. Title of publication for June, 1895: Nebraska Weather Review. Part of bulletin of experiment station, Vol. VIII, Art. 1. 8vo. Lincoln. 8 pp. Bulletin of Nebraska Weather Service was issued monthly from January, 1887, to May, 1893, by Goodwin D. Sweezy, Director Doane College Crete, Nebr.

NEW HAMPSHIRE—(*See* **NEW ENGLAND**).

NEVADA.—Central office, Carson City. Director, Charles W. Friend; Ford A. Carpenter,* assistant director. Organized February 1887, by act of legislature; C. W. Friend appointed director. First report, February, 1888, published by the State. First weather-crop bulletin, September, 1893. Number of stations July 1, 1895, 63. Title of publication for June, 1895: Monthly Review. Vol. IX, No. 1. 8vo. Carson City. 8 pp. First station was established September, 1887. First observation was taken October, 1887.

NEW ENGLAND.—(Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.) Central office, Boston. Director, J. Warren Smith.* Organized June, 1884, by New England Meteorological Society. All expenses were met by the New England Meteorological Society until January, 1888, after which Harvard College paid for composition till March, 1892. Since this date expenses have been met by cooperation with various New England societies and by private subscription. First report, November, 1884. Published by New England Meteorological Society. First weather-crop bulletin in 1887. Number of stations July 1, 1895, 177. Title of publication for June, 1895: Bulletin. No. 40. Royal. 8vo. Boston. 8 pp. Central station was at Cambridge until March 15, 1892.

NEW JERSEY.—Central office, New Brunswick. Director, E. W. McGann.* Organized November 1, 1886, by Dr. George H. Cook, Rutgers College. Established by legislature June 19, 1890, and $1,000 per year appropriated. April 17, 1892, State board of agriculture appropriated $100 per year. First report, November, 1886. Published by the State. First weather-crop bulletin, May 26, 1888. Number of stations July 1, 1895, 57. Title of publication for June, 1895: Bulletin. No. 104. 8vo. New Brunswick. 8 pp.

NEW MEXICO.—Central office, Santa Fe. Director, H. B. Hersey.* Organized July, 1891, by H. B. Hersey. First report, August, 1891 (miliographed). Published by U. S. Weather Bureau. First weather-crop bulletin, April, 1892. Legislative aid since February, 1895. Number of stations July 1, 1895, 31. Title of publication for June, 1895: Monthly Review of New Mexico Weather and Crop Service. Vol. I, No. 6. 8vo. Santa Fe. 13 pp., 1 pl.

NEW YORK.—Central office, Ithaca. Director, Prof. E. A. Fuertes; R. M. Hardinge,* assistant director. Organized September, 1888, by Prof. Fuertes, dean of the college of engineering, Cornell University. First report, September, 1888 (summary only), miliographed; published by the State commissioner of agriculture. Established by the State legislature April 15, 1889, with an annual appropriation of $4,500. Printed monthly reports (4to) and annual reports (8vo) issued since June, 1889. First weather-crop bulletin issued March 23, 1889. Number of stations July 1, 1895, 80. Title of publication for June, 1895: Report. Vol. VII, No. 6. 4to. Ithaca. 14 pp. 1 chart. Cornell University began a series of observations in 1874 which is still maintained.

NORTH CAROLINA.—Central office, Raleigh. Director, Dr. H. B. Battle; C. F. von Hermann,* assistant director. Organized December, 1886, by Dr. Chas. W. Dabney, director of North Carolina Experiment Station. First report, December, 1886. Published by State board of agriculture. First weather-crop bulletin, June 2, 1888. Number of stations July 1, 1895, 56. Title of publication for June, 1895: North Carolina Weather. 8vo. Raleigh. 1894. 13 pp. Prof. W. C. Kerr, State geologist, organized a system of observations at about 40 stations from 1870 to 1880. Partial results are printed in Geology of North Carolina, 1875. Vol. I. No observations from 1880 to 1886. No reports from November, 1888, to September, 1889, inclusive.

NORTH DAKOTA.—Central office, Bismarck. Director, B. H. Bronson.* Organized, July, 1891, by W. H. Fallon. The Chamber of Commerce aided in printing. March 16, 1893, the legislature appropriated $500 per year for two years. First report, July, 1891 (milliographed), published by the State. First weather-crop bulletin, April 8, 1892. Number of stations July 1, 1895, 44. Title of publication for June, 1895: Bulletin. Vol. 5, No. 6. 8vo. Bismarck. 16 pp.

OHIO.—Central office, Columbus. Director, W. W. Miller; Charles M. Strong,* assistant director. Organized April 17, 1882, by Dr. T. C. Mendenhall. Established by the general assembly April 17, 1882, and $2,000 appropriated. Maintained by legislative appropriations. First report, October, 1882. Published by the State. First weather-crop bulletin, April 9, 1892. Number of stations July 1, 1895, 125. Title of publication for June, 1895: Report of Weather and Crop Service. Issued in cooperation with the State board of agriculture. Issued in connection with Official Report on the Acreage and Condition of Crops. 8vo. Columbus. July, 1895.

OKLAHOMA.—Central office, Oklahoma City. Director, James I. Widemeyer.* Organized in the latter part of 1891 by Louis Dorman. First report, January, 1892 (milliographed), published by the director. First weather-crop bulletin, April 8, 1892. Number of stations July 1, 1895, 37. Title of publication for June, 1895: Monthly Bulletin. Vol. IV, No. 6. 8vo. Oklahoma. 7 pp.

OREGON.—Central office, Portland. Director, B. S. Pague.† Organized March, 1887, by B. S. Pague. Established by legislature February 25, 1889, sustained by legislature. First report, April, 1887. Published by the State. First weather-crop bulletin, March, 1889. Number of stations July 1, 1895, 60. Title of publication for June, 1895: Monthly (weather and crop) Report. No. 75. 8vo. Salem. 47 pp. Reports discontinued August, 1888, but resumed April, 1889.

PENNSYLVANIA.—Central office, Philadelphia. Director, W. P. Tatham; T. F. Townsend,* assistant director. Organized December 15, 1886, by the Franklin Institute. Established by legislature and $3,000 appropriated May 13, 1887. Aid received from Franklin Institute Advisory. First report, September, 1887, published by the State. First weather-crop bulletin, July 11, 1888. Number of stations July 1, 1895, 89. Title of publication for June, 1895: Monthly Weather Review. Issued under the direction of the Franklin Institute cooperating with the U. S. Department of Agriculture. Philadelphia. An appropriation was made in 1837 by the State for the purchase of instruments for securing meteorological records under the direction of the Franklin Institute. Very few records continued longer than two or three years. The Smithsonian system prevailed from 1850 to 1865. Reports were milliographed from June, 1891, to March, 1893, and from June, 1895. The printed reports (1887–1895) were published as an appendix to the journal of the Franklin Institute.

RHODE ISLAND—(*See* **NEW ENGLAND**).

SOUTH CAROLINA.—Central office, Columbia. Director, J. W. Bauer.* Organized in autumn of 1885, by Col. A. P. Butler, Commissioner of Agriculture. First report, January, 1887, published by the State Department of Agriculture. First weather-crop bulletin, in the summer of 1887. Number of stations July 1, 1895, 43. Title of publication for June, 1895: Monthly Report. Milliographed. 14 by 8 inches. Columbia. 3 pp., 1 ch. In December, 1890, the Department of Agriculture was abolished, including the weather service. A desultory organization was maintained by the Weather Bureau.

SOUTH DAKOTA (see also Dakota).—Central office, Huron. Director, S. W. Glenn.† Organized July, 1891, by S. W. Glenn. First report, July, 1891 (milliographed). Published by U. S. Weather Bureau. First weather-crop bulletin, March 9, 1889. Number of stations July 1, 1895, 44. Title of publication for June, 1895: Monthly Meteorological Summary. 14 by 8 inches. Huron. 8 pp. 1 ch. Milliographed.

TENNESSEE.—Central office, Nashville. Director, Maj. H. C. Bate.† Organized March, 1883, by the State Agricultural Bureau. First report, April, 1883. Published by State Agricultural Bureau and State Board of Health. First weather-crop bulletin in 1887. Number of stations July 1, 1895, 47. Title of publication for June, 1895: Tennessee Journal of Meteorology and Monthly Agricultural Review (a publication devoted to agriculture, climate, and science). Vol. IV, No. 8. 8 pp. Maj. A. J. McWhirter, commissioner of agriculture, was director from 1883 to July, 1885. The service was then transferred to the State board of health, and Dr. J. D. Plunket, president, was made director until September, 1891, when the service was reorganized and J. B. Marbury made director.

TEXAS.—Central office, Galveston. Director, Dr. I. M. Cline.† Organized April and May, 1888, by Dr. S. O. Young, managing editor of Galveston Daily News. First report, June, 1888, published by the Galveston Cotton Exchange. First weather-crop bulletin, July, 1888. Number of stations July 1, 1895, 93. Title of publication for June, 1895: Monthly Bulletin. Issued in cooperation with the Galveston Cotton Exchange. Vol. VIII, No. 6. 8vo. Galveston. 7 pp., 1 ch.

UTAH.—Central office, Salt Lake City. Director, J. H. Smith.* Organized September 16, 1891, by George N. Salisbury. First report, September, 1891 (milliographed), published by the U. S. Weather Bureau. First weather-crop bulletin, April 8, 1892. Number of stations July 1, 1895, 35. Title of publication for June, 1895: Monthly Report. 14 by 8 inches. Salt Lake City. 2 pp.

VERMONT.—(*See* **NEW ENGLAND.**)

VIRGINIA.—Central office, Lynchburg. Director, Dr. E. A. Craighill; J. N. Ryker,* assistant director. Organized May 25, 1890, by J. N. Ryker. First report, July, 1891, published by the State board of agriculture. First weather-crop bulletin, May 25, 1890. Number of stations July 1, 1895, 50. Title of publication for June, 1894: Monthly Report. Cooperating with State board of agriculture. Vol. V, No. 6. 8vo. Lynchburg. 11 pp. Mr. Ryker began to publish a weather-crop bulletin May, 1890.

WASHINGTON.—Central office, Seattle. Director, G. N. Salisbury.* Organized, in the summer of 1891, by Mr. E. B. Olney, Signal Corps, at Olympia. First report, August, 1891 (milliographed), published by the director. First weather-crop bulletin, in the spring of 1892. Number of stations July 1, 1895, 47. Title of publication for June, 1895: Monthly Meteorological Report and Summary. Milliographed. 14 by 8 inches. Seattle. 5 pp. Vol. V, No. 12. Central station was at Olympia until November, 1893. Reports were not issued for July, August, and September, 1892.

WEST VIRGINIA.—Central office, Parkersburg. Director, H. L. Ball.* Organized August, 1891, by W. W. Dent. First report, October, 1891 (milliographed), published by the U. S. Weather Bureau. First weather-crop bulletin, April 8, 1892. Number of stations July 1, 1895, 40. Title of publication for June, 1895: Monthly Meteorological Report. 14 by 8 inches. Parkersburg. 3 pp. Milliographed.

WISCONSIN.—Central office, Milwaukee. Director, S. C. Emory.* Organized October, 1890, by Robert E. Kerkam. First report, October, 1890 (milliographed), published by the director. First weather-crop bulletin, April 4, 1891. Number of stations July 1, 1895, 72. Title of publication for June, 1895: Wisconsin Weather and Crop Bulletin. Official publication of the Wisconsin Weather Service. 4to. Milwaukee. 4 pp. Monthly reports have been printed since January, 1892.

WYOMING.—Central office, Cheyenne. Director, E. M. Ravenscraft.* Organized in the fall of 1891 by E. M. Ravenscraft. First report, November, 1891 (milliographed), published by the U. S. Weather Bureau. First weather-crop bulletin, April 8, 1892. Number of stations July 1, 1895, 15. Title of publication for June, 1895: Monthly Bulletin. 4to. Cheyenne. 2 pp. Milliographed.

* Observer, U. S. Weather Bureau.
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NOTES BY THE EDITOR.

HORIZONTAL CLOUD ROLL.

The forms of clouds are almost innumerable, and observers will contribute to the advancement of meteorology by calling attention to any special form or modification that can be attributed to known peculiarities in the wind, the temperature, or the moisture. The passage of one layer of air over another is known to be frequently accompanied by one sort of wave formation at the boundary of the two strata. The relative velocities and the differences of density may be so related as to form rollers and breakers such as occur on the ocean. A case of this kind is noted by the Rev. S. W. Knipe, of Oceanic, on the coast of New Jersey, on June 3, in the current Meteorological Summary of the New Jersey Weather Service. He states that—

> The wind had been west all day. The temperature was 92° at 3 p. m. At 4 p. m. the wind changed to south, and then to east. Clouds soon assumed the shape of a cigar about 2 miles in length, extending nearly east and west about 300 feet above the earth. The eastern end seemed to reach a short distance over the ocean, while the other end extended up the river half way to Red Bank. As this roller passed over the river it was accompanied by very high wind and a great fall of temperature, 17° in twenty minutes. The wind lasted but a few minutes, and the temperature gradually rose again, but by 9 a. m. it had fallen to 64°.

Long rolls of invisible air are doubtless perpetually moving above us; the top of such a roll is often visible as a long straight cloud or band of stratus haze; but only rarely is the whole roll visible as a revolving cloud.

THE WEATHER AND THE BIRDS.

In the Bulletin of the New England Weather Service for June, the editor, Mr. J. Warren Smith, says:

> Many observers and correspondents having mentioned a general scarcity of birds this year, we have given the matter some investigation, and find that while the seed-eating birds like the scarlet hanger, flycatcher, the sparrows, and warblers, which winter mostly in the West Indies or farther south, are about as numerous as usual, the insect-eating birds which winter within the limits of the United States are unusually scarce. In many places where there are generally plenty of bluebirds, phœbes, robins and thrushes, one can search for hours and not find a bird or nest. It is thought the unusually cold weather last winter and spring in the Southern States killed some birds, and many of the insects that they feed on, so causing the indirect death of many more. With the absence of these birds there must undoubtedly be a large increase in the insect pests in New England, unless the farmers take extra care to destroy them, and their destructiveness will probably be more marked next season than this.

THE DRY NORTHERS OF CALIFORNIA.

Much of the damage done to agriculture is due to the dryness of the air rather than to its temperature. Plants that thrive in a moist warm atmosphere are injured by dry air no matter whether the temperature is higher or lower. One of the first observers to record the injurious influence of this dry wind was Dr. Thomas M. Logan, (see page 303, Smithsonian Report, 1857), where he attributes its dryness to the fact that it is coming from a northerly region where its moisture has been precipitated. In addition to this it is now known that a more important cause of dryness is the fact that, in most cases, the air has descended from great altitudes to the lower valleys, and has been warmed by compression. When such descending air is notably warmed up we have the hot, dry winds of Kansas; when it is only slightly warmed we have the cool, dry norther of California. An excellent example of the latter occurred in the first week of June, as recorded in the Bulletin for May of the California Weather Service, where Mr. James A. Barwick says:

> The reports from the various sections are very contradictory as to the effect of north wind on crops. In some places grain is reported to be badly damaged by shrinkage, especially the late-sown, which had passed the milky stage and was in the doughy state; this was somewhat shriveled, while that which was ripe and ready for the reaper was more or less shattered out and heads broken off by the high winds of the 7th and 8th. This north wind was much cooler than usual for the season of the year, on account of so much overflowed country across which this wind had to pass. The norther being so dry, caused rapid evaporation, and as evaporation from large bodies of water produces cold, it necessarily made the wind cooler than northerly winds usually do at this season of the year. Had the past season been one of small precipitation and little overflow in the tule basins, then the present norther would have done thousands of dollars' more damage than it has done at the present time, for no doubt the effects of the dry norther have been somewhat exaggerated both as to grain and fruits.